

REDESCRIPTION OF *ZONOPHRYXUS TRILOBUS*
RICHARDSON, WITH NOTES ON THE MALE
AND DEVELOPMENTAL STAGES
(CRUSTACEA: ISOPODA:
DAJIDAE)

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Abstract.—The mature female holotype of the dajid isopod parasite *Zonophryxus trilobus* Richardson is redescribed. Cryptoniscid larvae, males, and immature females from a specimen of pandalid shrimp *Heterocarpus gibbosus*, taken from the Philippines, are suggested to be conspecific with *Z. trilobus* and are described. It is also suggested that the immature female represents a possible evolutionary stage between the Bopyridae and the Dajidae.

While identifying caridean decapods collected by the R/V *Albatross* in Philippine waters in 1909, Dr. F. A. Chace, Jr., drew my attention to three small parasitic isopods on the carapace of a pandalid shrimp. After examination of these isopods, I decided that these possibly represented an immature phase of a previously described dajid. This paper provides descriptions of these newly-found cryptoniscid larvae, the male, and the immature female, as well as the mature female of *Zonophryxus trilobus*, and discusses the possible evolutionary implications of these developmental stages.

Suborder Epicaridea
Family Dajidae
Zonophryxus trilobus Richardson
Figs. 1-4

Zonophryxus trilobus Richardson, 1910:41, fig. 39.—Barnard, 1914:230.—Nierstrasz and Brender à Brandis, 1923:111.—Holthuis, 1949:7.

Description.—*Cryptoniscid Larva*: (Fig. 1a). Body dorsally convex, tapering posteriorly. Cephalon with semicircular anterior margin. Eyes absent. Pereon of 7 free segments; coxae anterolaterally rounded, posterodistally acute. Pleon of 6 free segments, decreasing in length and width posteriorly; last segment broadly triangular, apex evenly rounded. Antennules medially almost contiguous; basal segment attached transversely, with few setae; 2nd segment tripartite, consisting of broad proximal part, narrow lobe bearing 2 terminal setae, and low rounded tubercle bearing several

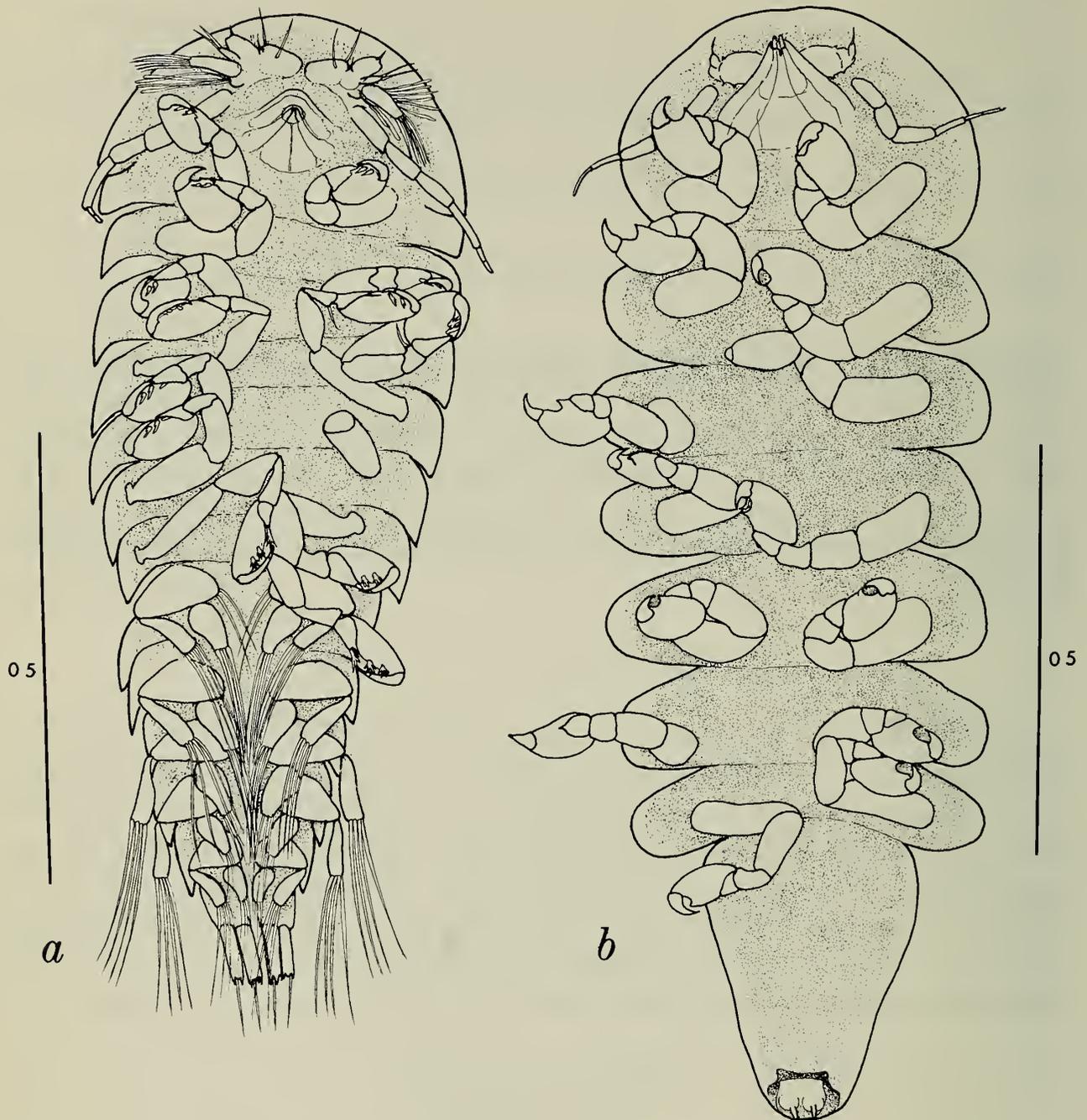


Fig. 1. *Zonophryxus trilobus*: **a**, Cryptoniscid larva in ventral view; **b**, Male in ventral view.

aesthetascs; terminal segment relatively elongate, bearing few terminal setae. Antenna elongate, of 4 relatively elongate proximal segments, and few distal articles (some possibly missing). Oral cone with anterior shield-like labium; 2 hollowed, distally sclerotized mandibles projecting from oral tube. 7 pairs of subchelate pereopods present, becoming slightly more elongate posteriorly; propodal palm bearing 2 serrate spines; carpus triangular, with distal spine becoming serrate in posterior pereopods. 5 pairs pleopods present, becoming shorter and narrower posteriorly; each with broadly triangular protopodite and 2 rami each bearing several elongate simple setae distally. Uropods with stout protopodite equal in length to cylindrical rami;

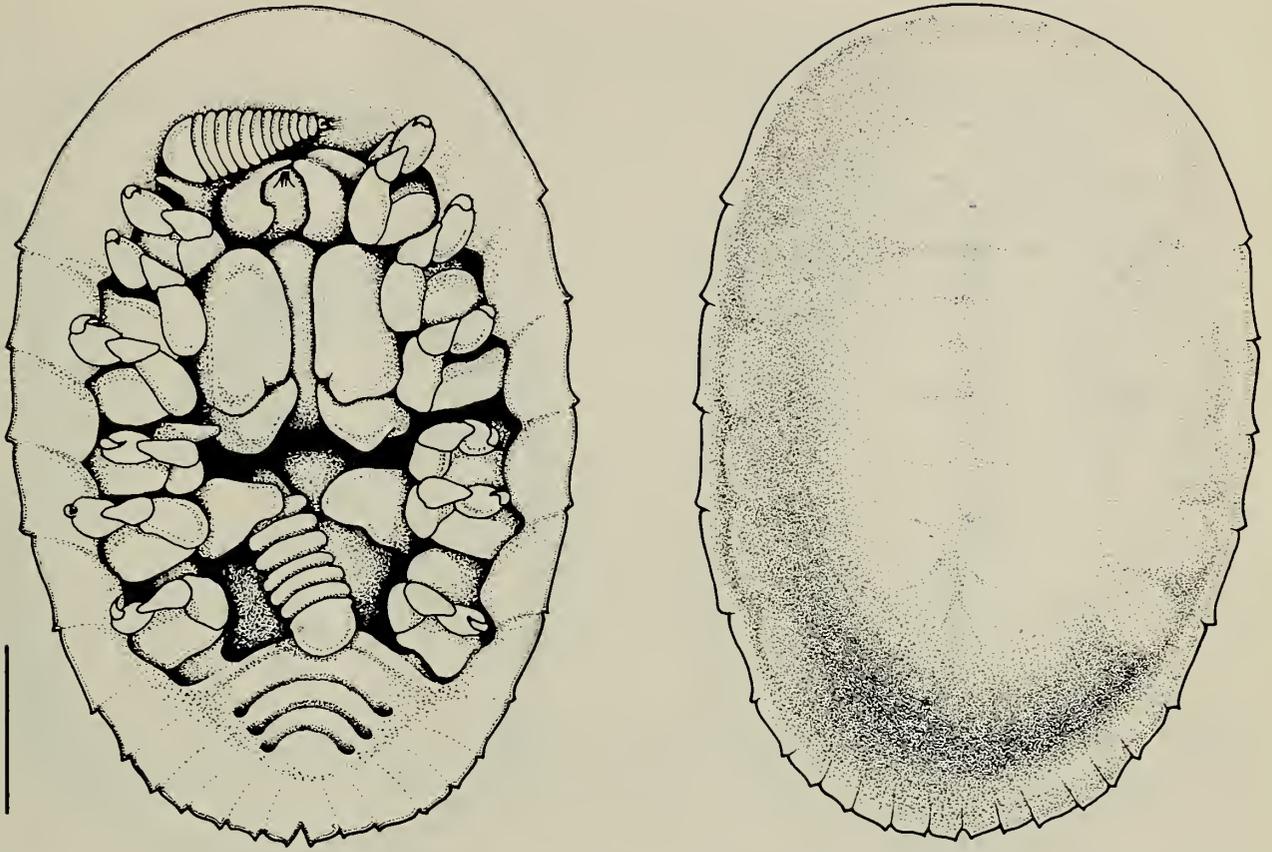


Fig. 2. *Zonophryxus trilobus*: Ventral and dorsal view of immature female.

inner ramus slightly wider than outer; both with 2 short distal spines and single elongate spine.

Male.—(Fig. 1b). Cephalon and 1st pereonite fused; cephalothorax oval in outline. Eyes absent. 6 free laterally-rounded pereonites present. Pleotelson a single pyriform segment. Antennule a single biad segment bearing few short spines, with single setae on terminal papilla. Antenna of 4 relatively elongate basal segments and ?2 distal articles. Hallowed sclerotised mandibles projecting from oral cone. 7 pairs robust subchelate pereopods present, each with concave propodal palm bearing proximal spiniform process. Pleotelson lacking appendages except for small pair uniramous uropods situated in ventrodistal hollow.

Immature female.—(Fig. 2). Body dorsally strongly convex, oval in outline; cephalon, pereonites and pleonites fused, segmentation of pereon and pleon indicated by notches and small points on circumference; faint indications of segmentation middorsally. Cephalon with broad convex flange. Pereonite 1 fused with cephalon. Antennule expanded into lamella embracing oral cone. Antenna a simple digitiform process attached to outer region of antennular lamella. Oral cone with 2 projecting sclerotized mandibles. Median sternum posterior to oral cone raised into ridge embraced by large bilobed oostegite of pereopod 1. 6 pairs subchelate pereopods present, each of 6 segments (including coxa); propodal palm slightly convex. Pereopods

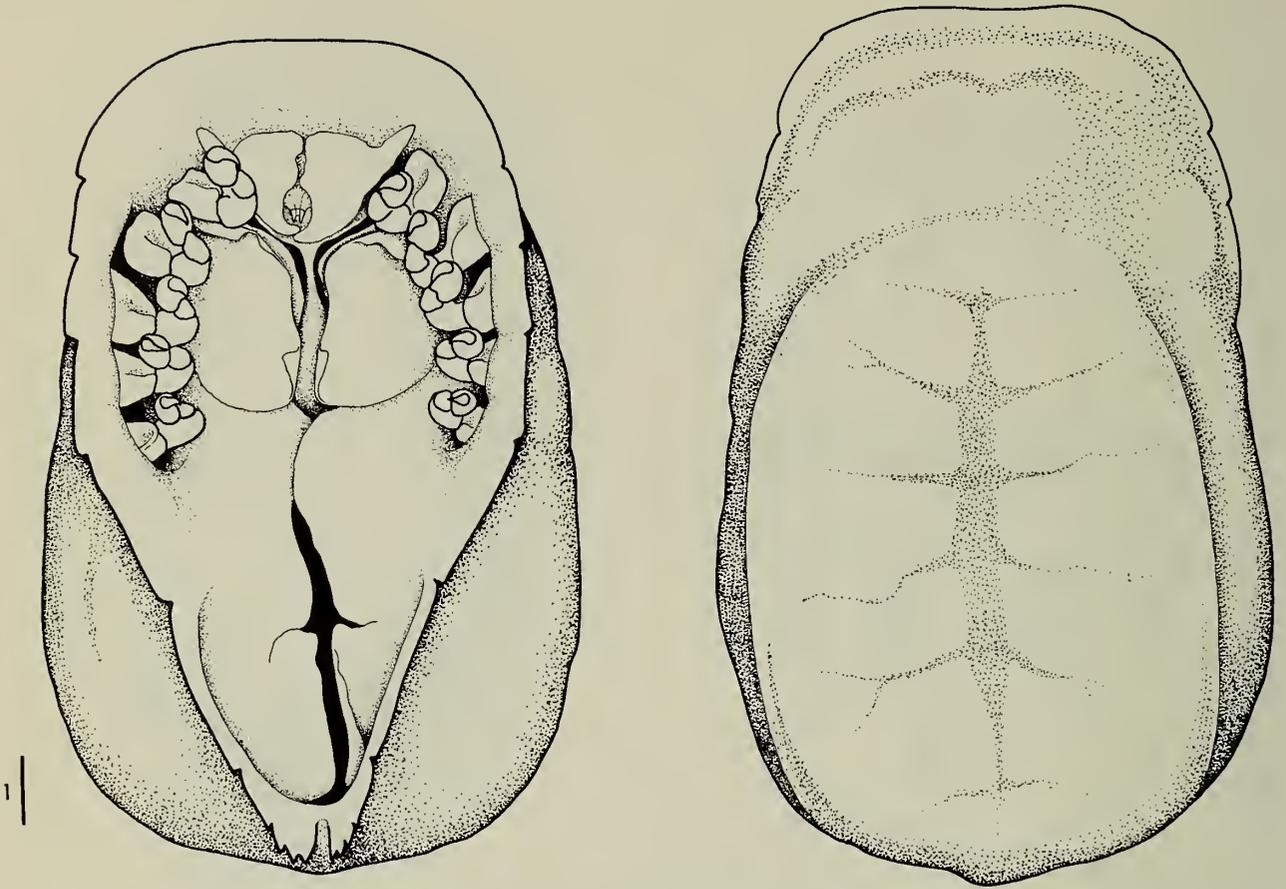


Fig. 3. *Zonophryxus trilobus*: Ventral and dorsal view of mature female holotype.

2–5 with small oval oostegites; pereopod 6 lacking oostegite; body wall between pereopods 5 and 6 with small lamellar fold. Pleonal segments indicated by curved transverse grooves in sternum.

Mature female.—(Fig. 3). Body dorsally strongly convex, oval in outline, with faint irregular lines and grooves indicating segmentation. Ventral flange anteriorly wide, converging posteriorly, with several notches and points on circumference, 4 posterior points on each side close together. Antennules, antennae, and oral cone as in immature ♀. 5 pairs subchelate pereopods. Median sternum posterior to oral cone raised into ridge, embraced by oval oostegite of pereopod 2 overlying oval oostegite of pereopod 1. Oostegites of pereopods 3 and 4 broad, membranous, reaching ventral midline, covered ventrally by broad expansion of body wall posterior to pereopod 5, covering entire posterior ventral surface, meeting midventrally, divided into large anterior and smaller posterior lobe.

Material.—*Zonophryxus trilobus*: Holotype, mature ♀, USNM 40927, TL 13.0 mm. Albatross sta. 5259, off Caluya Is., Sulu Archipelago, Philippines, 570 m. Immature ♀♀, TL 5.0 mm, 4.1 mm, 3.0 mm; 2♂♂. TL 1.4 mm; Cryptoniscid larvae, TL 1.0 mm. Albatross sta. 5622, west of Halmahera Is., Indonesia, 503 m.

Habitat.—Two of the three immature females were found attached to the carapace at the left base of the rostrum of the pandalid shrimp *Heterocarpus*

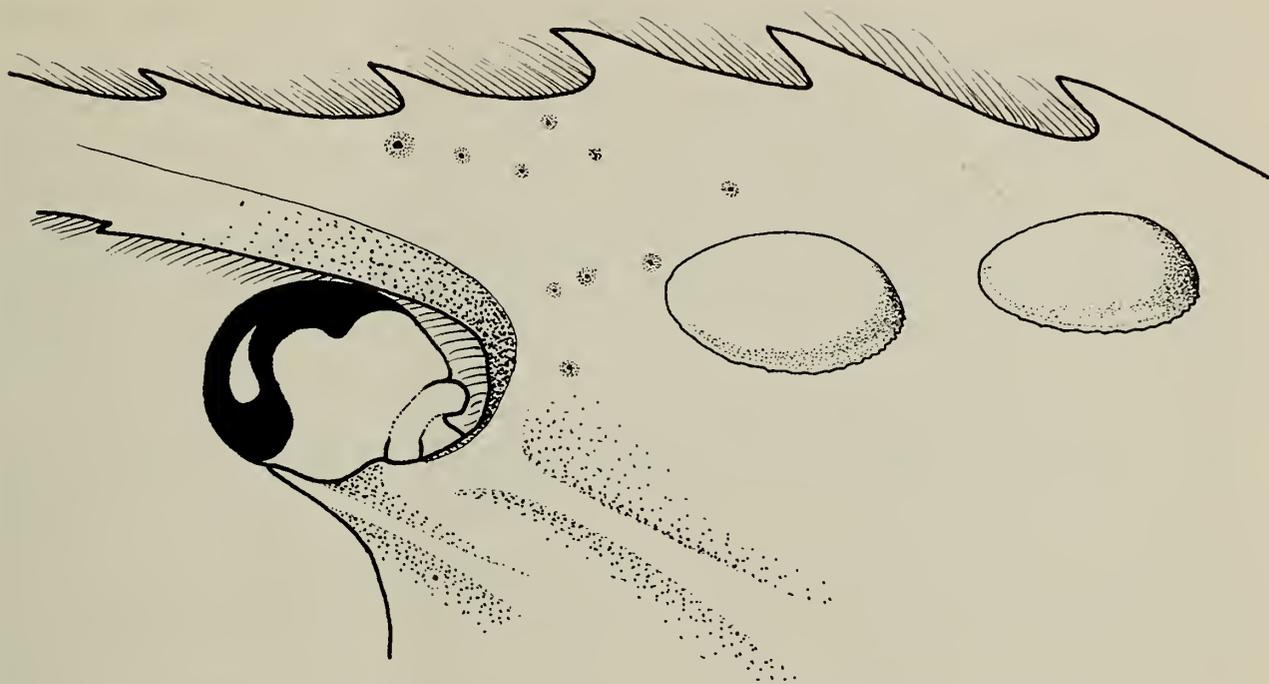


Fig. 4. Anterior carapace and rostral base of *Heterocarpus gibbosus* with puncture marks and immature female *Zonophryxus trilobus* in situ.

gibbosus Bate, 1888 (see Fig. 4). In the same region of the carapace were several small circular punctures each surrounded by a discolored area, presumably the result of the parasites' feeding. The third female was found loose in the bottle with the shrimp. The largest immature female had a male attached to the pleon, and a cryptoniscid in the cephalon region. The smallest female had a cryptoniscid amongst the pereopods, while the third female had a male on the ventral surface.

The holotype of *Z. trilobus*, unfortunately, was taken from a trawl free of any host.

Remarks.—On the basis of several similarities, it is proposed that the small hemispherical isopods taken from the anterior carapace of *Heterocarpus gibbosus* could be immature females of *Zonophryxus trilobus* Richardson. The similarities include similar structure of the fused antennules and antennae, pereopod structure, the raised mediosternum of the anterior pereonites embraced by the oostegite of pereopod 1, the notches and points in the circumference indicating the segmentation of the pereon and pleon.

It is suggested that development of the ovaries/eggs leads to a general distention of the body, especially in the region of pereonites 5 and 6 (as indicated by the increased distances between notches on the circumference flange of the mature female). This distention, being mainly in the dorsal region, leads to the convergence of the posteroventral body margin characteristic of *Zonophryxus*. At the same time, the lamellar section of the body wall between pereopods 5 and 6 increases in size, leading to a complete closure of the ventral brood pouch and a simultaneous suppression of pereopod 6.

The presence of cryptoniscid larvae on the small females is perhaps also evidence of immaturity.

The broad lamellar outgrowths on each side of the body wall in the region of the 5th and 6th pereopods are also seen in *Z. dodecapus* (Holthuis, 1949) where they are referred to as oostegites. In this Atlantic species, the sixth pereopods are retained in the mature female and are situated posteriorly.

Apart from the development of eggs and the brood pouch, the loss of the 6th pair of pereopods seems to be the major change from immature to mature female. This cannot be regarded as unusual, as the change from cryptoniscid larva to immature female also involves the loss of a pair of legs.

The immature female form described here may represent a stage in the evolution between bopyrid and dajid epicarideans. The change from cryptoniscid to adult female bopyrid (the latter generally with seven pairs of pereopods, five pairs of pleopods and one pair of uropods) requires little change in the state of the pereonal and pleonal appendages. The next step towards the more modified dajids is represented by the immature female described above, with six pairs of pereopods and some pleomeres distinguishable, but no pleopods. Loss of another one or two pairs of pereopods, and thereby the concentration of the remaining pereopods in the anterior pereon, and complete obliteration of the pleomeres, would result in the more typical dajid.

Acknowledgments

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